CLAIMS: *The following is a listing of all claims in the application with their status and the text of all active claims.*

1. – 23. (CANCELED)

24. (ORIGINAL) An apparatus for on-line monitoring the cell concentration of biological culture medium in a shaking environment of an incubator/shaker, comprising:

a container that can hold a liquid biological culture medium in which biological cells are incubated, and at least a part of the container's wall is optically transparent;

at least one light emission source means for emitting light to interact with said biological culture medium through the transparent wall of said container;

at least one photodetector means for directly detecting scattered or transmitted light by said biological culture medium through the transparent wall of said container when the emitted light from said light emission source interacts with said biological culture medium;

a probe fixture means for mounting and orientating at least one said light emission source and at least one said photodetector in fixed positions relative to each other, and for holding said container firmly without any relative movement with respect to said light emission source, said photodetector and a shaking platform of said incubator/shaker during the on-line monitoring process while said container and the probe fixture are under a continuously shaking condition;

processing means for detecting and amplifying electrical signal from said photodetector, and then for further processing the signal and presenting the monitoring results of the biological cell culture.

25. (ORIGINAL) An apparatus of claim 24, wherein said light emission source is a diode laser with a focus lens for generating a laser beam, wherein said photodetector is a photodiode.

26. (ORIGINAL) An apparatus of claim 24, wherein said processing means including means for analog signal to digital data conversion and a microprocessor means for digital data processing, and wherein the digital data processing further including a filter algorithm for filtering large fluctuation noise caused by shaking culture medium and a moving averaging algorithm for reducing signal fluctuation.

27. (ORIGINAL) An apparatus of claim 24, wherein said probe fixture means further including:

a container clamp means for holding the container;

a detection probe means for housing said light emission source and said photodetector and positioning the photodetector relative to the light emission source, and further for housing circuit means for detecting and amplifying electrical signal from the photodetector;

a mounting means for firmly attaching the clamp means with the detection probe means so that the light source and photodetector are positioned around the bottom corner of the container;

a light guide means for narrowing the irradiation and viewing angle of the light emission source and the photodetector, respectively;

a dark shield cover means for reducing ambient light into the container.

28. (ORIGINAL) An apparatus of claim 24, wherein said container is an Erlenmeyer flask.

29. (ORIGINAL) A turbidity detecting apparatus of claim 24, further including a pulse generating circuit means for generating light pulse beam from the light emission source, and a pulse gated signal detection means for detecting and distinguishing the signal of the photodetector between light-on and light-off state

30. (ORIGINAL) An apparatus of claim 24, further including one or more probe fixtures and a signal relay module means for transferring signals between the multiple probe fixtures and the electronic module via wires or wireless means.

31. (ORIGINAL) An apparatus of claim 24, wherein the probe fixture is further integrated with the shaking platform of the incubator/shaker, and wherein said processing means is integrated with the circuit of the incubator/shaker.

32. (ORIGINAL) An apparatus of claim 31, wherein further includes means for controlling and regulating the shaking speed and temperature of the incubator/shaker based on measured cell concentration in culture medium.

33. (ORIGINAL) An apparatus of claim 24, wherein the processing means further including data conversion means for converting original signal data to standardized turbidity for biological culture medium through calibration process with a known turbidity standard.

34. (ORIGINAL) An apparatus of claim 24, wherein the processing means further including data conversion means for converting signal data to optical density for biological culture medium through calibration process that comprising the steps of:

making at least two set measurements on signal data and the optical density from an off-line spectrophotometer for the biological cells with different concentration;

calculating the coefficients of a polynomial expression for the calibration through a curve fitting process based on the above measurements, wherein the number of the measurement set should be equal to or larger than the number of the coefficients.

35. (ORIGINAL) A method for on-line monitoring the cell concentration of biological culture medium in a shaking environment of a incubator/shaker, comprising:

utilizing a container to hold a liquid biological culture medium in which biological cells are incubated, and at least a part of the container's wall is optically transparent;

positioning a light emission source relative to the transparent wall of said container and irradiating light through the wall of said container and interacting with said biological culture medium;

positioning and aiming at least one photodetector to detect light from the interacting section of the incident light with the biological culture medium;

fixing the position of said photodetector with respect to said light emission source outside of said container;

preventing the relative movement of said container with respect to the position of the light emission source, the photodetector and the shaking platform of the incubator/shaker during the on-line monitoring process while said container and the probe fixture are under a continuously shaking condition;

providing processing means for detecting and amplifying electrical signal from said photodetector, and for further processing the signal and presenting the monitoring results of the biological cell culture.

36. (ORIGINAL) A method of claim 35, wherein further comprising steps of:

arranging the location and emission angle of the incident light from said source to submerge in the culture medium, and avoid its light path to go through the interface between the culture medium and air directly in the container when the biological culture medium is under continuously shaking condition;

aiming the photodetector to the entry or near entry area of said interacting section;

narrowing the irradiation and viewing angle of the light emission source and the photodetector, respectively;

providing an opaque shield cover means for reducing ambient light into the container.

37. (ORIGINAL) A method of claim 35, wherein the container is an Erlenmeyer flask.

38. (ORIGINAL) A method of claim 35, wherein further comprising a step of utilizing a noise filter algorithm and a moving average algorithm to enhance signal to

noise ratio and reduce the fluctuation noise when the biological culture medium is under a continuously shaking condition.

39. (ORIGINAL) A method of claim 35, wherein further comprising a step of performing data conversion from original signal data to standardized scattering turbidity values for biological culture medium through calibration process with a known turbidity standard.

40. (ORIGINAL) A method of claim 35, wherein further comprising a step of performing data conversion from signal data to the concentration of biological cells through calibration process comprising the steps of:

making at least two set measurements on the signal data and their corresponding concentration values for the biological culture medium with different concentration;

calculating the coefficients of a polynomial expression for the calibration through a curve fitting process based on the above measurements, wherein the number of the measurement set should be equal to or larger than the number of the coefficients.

41. (ORIGINAL) A method of claim 40, wherein said the concentration of biological cells is represented by optical density.

42. (ORIGINAL) A method of claim 35, wherein further comprising the steps of:

embedding the light emission source and the photodetector in the shaking platform of an incubator/shaker;

integrating the signal and data processing means with the circuit of the incubator/shaker.

43. (CURRENTLY AMENDED) A method of claim [35 or] 42, wherein further comprising a step of controlling automatically the shaking speed and the

temperature of the incubator/shaker based on the monitoring results of the biological cell culture.

44. (ORIGINAL) An apparatus for on-line monitoring the cell growth curve of biological cell culture in a shaking environment of an incubator/shaker, comprising:

a container that can hold a liquid biological culture medium in which biological cells are incubated, and at least a part of the container's wall is optically transparent;

at least one light emission source means for emitting light to interact with said biological culture medium through the transparent wall of said container;

at least one photodetector means for directly detecting scattered or transmitted light by said biological culture medium through the transparent wall of said container when the emitted light from said light emission source interacts with said biological culture medium;

a probe fixture means for mounting and orientating at least one said light emission source and at least one said photodetector in fixed positions relative to each other, and for holding said container firmly without any relative movement with respect to said light emission source, said photodetector and the shaking platform of said incubator/shaker during the on-line monitoring process while said container and the probe fixture are under a continuously shaking condition;

processing means for detecting and amplifying electrical signal from said photodetector, and for further processing the signal and presenting the scattering properties of the biological cell culture.

45. (ORIGINAL) A apparatus of claim 44, wherein said probe fixture further including at least one reference photodetector and a differential photodetector electronic circuit; wherein means for compensating the emission light intensity change and the photodetector sensitivity change due to thermal drift.